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ABSTRACT

This study examined the internal/external (I/E) frame of reference model of self-concept (Marsh, 1986) with higher education students in Hong Kong (n=274). Structural equation models relating English and math achievement (both requirements for university entrance) to English and math self-concepts replicated the I/E model in that paths leading from prior achievement to subsequent self-concept in matching curriculum domains were positive and statistically significant, indicating a strong external social comparison of students' own competence with the competence of other students in forming their self-concepts; paths from prior achievement to subsequent self-concept in nonmatching domains were negative and statistically significant, indicating a strong internal comparison between students' own competence in different curriculum areas. When the model was tested with Chinese (the students' mother tongue but not a requirement for higher education), paths relating matching curriculum domains were significantly positive as expected, indicating a strong external frame of reference; paths relating nonmatching domains were close to zero, indicating that the internal comparison between subject areas was weak. The study extends previous research by demonstrating that the I/E model is applicable to higher education students, but only when both the verbal and math achievements are salient sources of feedback for the development of self-concept in an academic setting. (Contains 33 references.) (Author/DB)

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The Internal/External Frame of Reference in the Self-Concept Development of Higher Education Students

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Paper presented at the Conference of the Higher Education Research and Development Society of Australasia in Auckland, New Zealand, 7-10 July 1998.

Abstract

This study examined the internal/external frame of reference (I/E) model of self-concept (Marsh, 1986) with higher education students in Hong Kong (N = 274). Structural equation models relating English and maths achievement, that are both essential requirements for university entrance, to English and maths self-concepts replicated the I/E model in that paths leading from prior achievement to subsequent self-concept in matching curriculum domains were positive and statistically significant, indicating a strong external, social comparison of students' own competence with the competence of other students in forming their self-concepts; whereas paths from prior achievement to subsequent self-concept in nonmatching domains were negative and statistically significant, indicating a strong internal comparison between students' own competence in different curriculum areas. When the model was tested with Chinese that was the students' mother tongue but not an essential requirement for higher education, although paths relating matching curriculum domains were significantly positive as expected, indicating a strong external frame of reference, paths relating nonmatching domains were close to zero, indicating that the internal comparison between subject areas were weak. The study extends previous research by demonstrating that the I/E model is applicable to higher education students, but only when both the verbal and maths achievements are salient sources of feedback for the development of self-concept in an academic setting.

With a growing body of literature on the study of self-concept in the last two decades, the construct is now better understood and measured as a multidimensional construct instead of the traditional global composite. Shavelson, Hubner, and Stanton (1976) proposed a hierarchical, multidimensional model of self-concept that posited a general (global) self-concept at the apex under which were academic and nonacademic self-concepts which were further divided into domain specific areas such as verbal and maths self-concepts. Subsequent research focusing on the multidimensional nature of academic self-concept well supported this domain specificity (e.g., Byrne, 1984;

Marsh, 1993b; Marsh, Byrne, & Shavelson, 1988; Marsh & Yeung, 1997b). However, repeated findings found a surprising nonpositive relationship between the verbal and maths self-concepts (e.g., Marsh, 1986; Marsh, Byrne, & Shavelson, 1988). Thus, the verbal and maths self-concepts could not be combined to form a higher-order academic self-concept factor. To provide a possible explanation for this nonpositive relationship, Marsh (1986) introduced an internal/external frame of reference (I/E) model suggesting that students tend to compare themselves with others (external frame of reference) and also compare their own performance in different subject domains (internal frame of reference). According to the model, the positive effects of prior achievement on subsequent self-concept development in matching subject domains tend to be balanced out by the negative effects due to an internal comparison between different domains. Several studies have replicated the I/E model in different settings (e.g., Skaalvik & Rankin, 1995) but little work has been done with students of higher education.

According to the I/E model, students are subjected to an external as well an internal frame of reference and, therefore, their respective maths and verbal self-concepts are influenced both by external and internal comparisons. The external frame of reference refers to the comparison between the student's perceived academic ability and the abilities of other students in a given environment (e.g., the academic institution, peers). The internal frame of reference refers to the student's comparison of perceived ability in one subject domain with perceived ability in another subject domain. Hence, a student with a comparatively lower maths achievement among the peer group may have a significantly lower maths self-concept due to the external comparison, but may have a relatively higher maths self-concept than English self-concept if English, instead of maths, is the student's lower performance in school.

Using a CFA approach to test the I/E model, Marsh (1986) demonstrated a positive effect of maths achievement on Maths self-concept and a positive effect of verbal achievement on Verbal self-concept, but a negative effect of maths achievement on Verbal self-concept and a negative effect of verbal achievement on Verbal self-concept. Subsequent studies on the I/E model based on the English version of the SDQ have been very supportive of these findings (e.g., Byrne & Shavelson, 1987; Marsh, Byrne, & Shavelson, 1988). Furthermore, apart from Marsh's Australian sample, studies of the I/E model conducted in countries such as Norway (Skaalvik & Rankin, 1995), Spain (Gonzalez-Pienda, Nunez-Perez, & Valle-Arias, 1992) and North America (Tay, Licht, & Tate, 1995) also supported the generalisability of the model.

A number of studies have also demonstrated the generalisability of the I/E model irrespective of the instrument used. Marsh , Byrne & Shavelson (1988) found consistent support for the I/E model when using different instruments such as the Self Description Questionnaire, Affective Perception Inventory, Self-esteem Scale, and the Self-concept of Ability Scale as well as the combined self-concept scores. Tay, Licht, and Tate (1995) found patterns that were highly consistent with the I/E model using the Academic Perception Questionnaire. Similarly, the I/E model was also supported in the Skaalvik and Rankin (1995) study in which measures of self-concept, self-perceived aptitude, and self-perceived ability to learn were combined into single maths and verbal latent variables.

To educational researchers and even teachers, the intricate relationship between academic achievement and academic self-concept has always been a critical concern. The I/E model explains, at least partly, the formation of academic self-concept and the relationship between academic self-concept and academic achievement from a multidimensional perspective. In an attempt to extend the traditional I/E model, this study introduces a third, and perhaps equally salient, academic domain in the I/E comparison -- the Verbal Chinese self-concept (the first language but not necessarily the language of instruction at schools and universities for the higher education students in a Hong Kong sample). The introduction of a third academic construct has the potential of adding new dimensions in the

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understanding of the I/E model in a given academic environment. To date, this is also the first attempt in introducing an alternate verbal domain in the I/E model administered to a group of bilingual higher education students in a non-western culture.

Method

Participants

The participants of this study were 321 students from a higher education institution in Hong Kong. Students came from different disciplines of study enrolling in either degree and higher diploma courses. The survey was done in English communication classes which were made compulsory to all the participants. Age of the students varied from 17-28. Of all the 321 questionnaires that were completed and returned, only 274 could be used in the analysis due to missing data of some kind.

Materials

The Academic Self-Concept Measures. Three domain-specific academic self-concept scales: English, Chinese and Maths were adapted from Marsh's (1990) Academic Self Description Questionnaire (ASDQ). Each construct comprised of 6 items using an 8-point response scale (1=definitely false to 8=definitely true). These items were scored such that high scores represented favorable responses.

Achievement Scores. Apart from maths achievement which was represented by a single indictor, there were two achievement indicators in both English and Chinese domains. All these indicators were scores gained in two public examinations in the country over the span of two years in the senior high school prior to entry to higher education studies, and were the basis for universities and colleges in their selection for students.

Statistical Analyses

We first conducted an exploratory factor analysis (EFA) for the English, Chinese and Maths academic self-concept constructs based on the 18 variables pertaining to these respective constructs in the design of Marsh's ASDQ. Results of EFA clearly identified the three factors. Subsequent analyses were conducted with item pair scores in confirmatory factor analysis (CFA). In Model A, the three item pairs of the 2 constructs (English and Maths) and three achievement indicators produced a 9 x 9 covariance matrix on which the CFAs were based (see Table 2). Similarly, in Model B, the three item pairs of the 2 constructs considered (Chinese and Maths) and three corresponding achievement indicators produced a 9 x 9 covariance matrix (Table 3). The workings of the CFA and the use of item pairs were best explained and described in Bollen (1989; also see Byrne, 1989; Joreskog & Sorbom, 1993; Marsh, 1994; Marsh & O'Neil, 1984) and is not further discussed in this paper. The SPSS version of LISREL (Joreskog & Sorbom, 1988) was used to explore the a priori models considered here. Also, taking the suggestions of Marsh, Balla, and McDonald (1988) and Marsh, Balla and Hau (1996), the Tucker-Lewis index (TLI) was used as the primary, critical index for model fit in the present study. We first examined the reliabilities of constructs and how well the measured variables were represented by each construct. Then we tested Marsh's (1986) I/E model of self-concept development that is represented in Figure 1.

Results and Discussion

Preliminary Analysis

Reliability estimates for the English, Chinese, and Mathematics academic self-concept scales were high (alphas = .95, .91, .94 respectively). Results of the EFA yielded the three distinct factors with factor loadings ranging from .63 to .95, the weakest being the negative item in the scale (I am hopeless when it comes to 'subject area') showing factor loadings of .73, .70, .63, respectively. Subsequent tests of the I/E model were based on these a priori

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constructs. Table 1 shows the goodness of fit summary and Tables 2 & 3 show the CFA solutions of the two models considered in the present context.

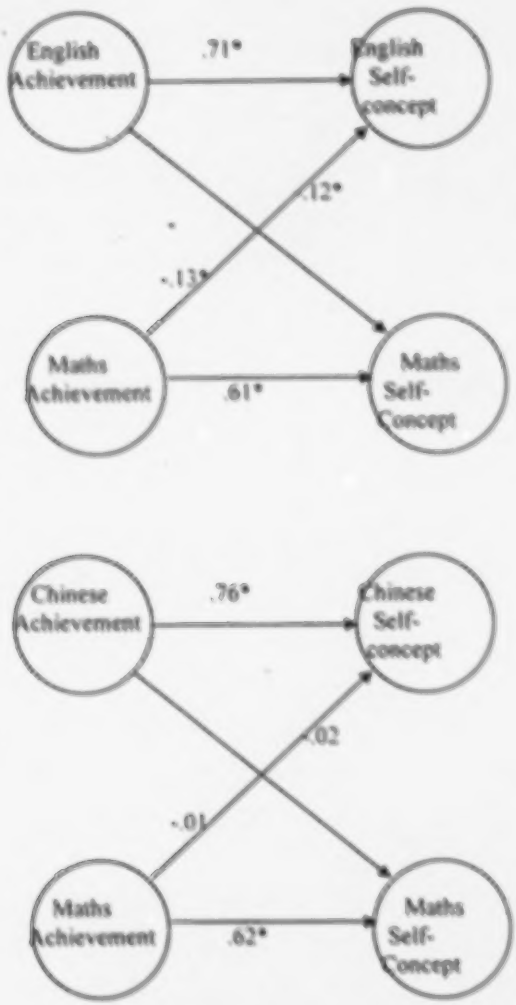

Figure 1. Structural models testing Marsh's (1986) I/E model with (a) English and maths achievement scores, and (b) Chinese and maths achievement scores, and their respective self-concepts.

Table 1
Goodness of Fit Summary for Models

Model	χ2	*df*	RNI	TLI	GFI
Null	2329.53	36			
English & Maths	53.56	19	.985	.971	.961
Null	1910.89	36			
Chinese & Maths	56.76	19	.980	.962	.958

Note: N = 274. RNI= Relative noncentrality index. TLI= Tucker-Lewis index. GFI= Goodness-of-fit index.

Table 2 (English & Maths)
CFA Solution for English and Maths I/E Model

	Mean	SD	Factor Loadings				Uniq	Correlations between measured variables								
			ENGAc	MATAc	ENG	MAT		1	2	3	4	5	6	7	8	9
English Achievement																
1 ENGAc1	7.03	1.74	82*	0	0	0	32*	--								
2 ENGAc2	7.99	1.81	82*	0	0	0	32*	68	--							
Maths Achievement																
3 MATAc	8.54	1.96	0	1	0	0	0	-10	-19	--						
English Self-concept																
4 ENG1	5.29	1.38	0	0	87*	0	24*	57	56	-27	--					
5 ENG2	4.68	1.46	0	0	95*	0	10*	57	58	-22	83	--				
6 ENG3	4.72	1.45	0	0	98*	0	05*	60	58	-24	85	93	--			
Maths Self-concept																
7 MAT1	4.86	1.48	0	0	0	84*	29*	-11	-16	59	-00	-07	-03	--		
8 MAT2	4.28	1.73	0	0	0	98*	03*	-14	-25	61	-14	-14	-09	83	--	
9 MAT3	4.35	1.64	0	0	0	94*	11*	-15	-24	59	-19	-16	-11	79	93	--
Path Coefficients																
English self			71*	-12*												
Maths self			-13*	61*												
Correlations between constructs																
EngAc			--													
MatAc			-18*	--												
English self			73*	-25*	--											
Maths self			-24*	63*	-12*	--										
Residuals and correlated residuals																
EngAc			1													
MatAc			-18*	1												
English self			0	0	45*											
Maths self			0	0	13*	59*										

Note. N = 274. The four constructs were English Achievement (ENGAc) derived from two indicators (1 and 2), Maths Achievement (MATAc), English self-concept (ENG), and Maths self-concept (MAT). The self-concept scales were inferred from 3 item pairs (1 to 3) each for ENG and MAT. Uniq = uniqueness. Parameters estimates and item correlations range from 0 to 1 but are presented without decimal points. Values of 0 or 1 were fixed in the definition of the model. * $p < .05$

Table 3 (Chinese & Maths)
CFA Solution for Chinese and Maths I/E Model

	Mean	SD	Factor Loadings				Uniq	Correlations between measured variables								
			CHIAc	MATAc	CHI	MAT		1	2	3	4	5	6	7	8	9
Chinese Achievement																
1 CHIAc1	6.65	1.81	73*	0	0	0	47*	--								
2 CHIAc2	7.75	1.95	60*	0	0	0	64*	43	--							
Maths Achievement																
3 MATAc	8.54	1.96	0	1	0	0	0	-07	-20	--						
Chinese Self-concept																
4 CHI1	4.91	1.51	0	0	86*	0	27*	48	40	-18	--					
5 CHI2	4.70	1.56	0	0	93*	0	14*	51	38	-13	80	--				
6 CHI3	4.68	1.42	0	0	93*	0	14*	54	43	-13	78	86	--			
Maths Self-concept																
7 MAT1	4.86	1.48	0	0	0	84*	29*	01	-17	59	01	-01	03	--		
8 MAT2	4.28	1.73	0	0	0	98*	03*	-02	-16	61	00	03	04	83	--	
9 MAT3	4.35	1.64	0	0	0	94*	11*	-07	-15	59	-09	-03	-01	79	93	--
Path Coefficients																
Chinese self			76*	-02												
Maths self			-01	62*												
Correlations between constructs																
ChiAc			--													
MatAc			-18*	--												
Chinese self			76*	-15*	--											
Maths self			-12	63*	02	--										
Residuals and correlated residuals																
ChiAc			1													
MatAc			-18*	1												
Chinese self			0	0	42*											
Maths self			0	0	12*	61*										

Note. N = 274. The four constructs were Chinese Achievement (CHIAc) derived from two indicators (1 and 2), Maths Achievement (MATAc), Chinese self-concept (CHI), and Maths self-concept (MAT). The self-concept scales were inferred from 3 item pairs (1 to 3) each for CHI and MAT. Uniq = uniqueness. Parameters estimates and item correlations range from 0 to 1 but are presented without decimal points. Values of 0 or 1 were fixed in the definition of the model. * $p < .05$

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Model A: The English-Maths Model

This model tested the applicability of the I/E theory using the English and Maths ASDQ responses and their matching achievements. Paths between latent variables were posited in Figure 1a. This model converged to a proper solution with a good fit (RNI=.985, TLI=.971). Consistent with the I/E model (Marsh, 1986), the path coefficient from maths achievement to Maths self-concept (.61) was positive and significant whereas that from maths achievement to English self-concept (-.12) was negatively significant. In the same way, the path from English achievement to English self-concept (.71) was positive and significant whereas the path to its nonmatching Maths self-concept (-.13) was negatively significant. In sum, the paths of this model supported the traditional I/E model although the magnitude of the negative paths (internal comparison) were generally small.

Model B: The Chinese - Maths Model

As shown in Table 1, the model converged to a proper solution with a good fit (RNI=.980, TLI=.962). The path coefficients between the latent variables were illustrated in Figure 1b. Whereas both paths of external comparison were positive and significant (.76 and .62 respectively for Chinese achievement to Chinese self-concept and maths achievement to Maths self-concept), as predicted by the I/E model, the paths from Chinese achievement to Maths self-concept (-.01) and from maths achievement to Chinese self-concept (-.02) were nonsignificant and close to zero. This result provides only partial support for the traditional I/E model. Essentially, there was support for only the external comparisons described in the I/E theory but rather weak and nonsignificant internal comparisons between subject areas for the students investigated in this study.

For the present Hong Kong sample, English is clearly the verbal domain in an educational setting because English has been adopted as the language of instruction at schools and higher education for over one hundred years. Chinese, on the other hand, is the first language of these students. The differential relations of these two languages with maths achievement and self-concept found in the present study have interesting implications. When two salient academic domains, such as English and maths, were tested in the I/E model, both external and internal comparisons were at work in influencing each other. Nevertheless, when a less salient "academic" domain, such as Chinese, was introduced, despite being the first language, the students were less inclined to compare internally, although the external comparison was still distinct. This result has helped to unfold, in part, the development of self-concept among higher education in a given academic setting. When two salient domains, such as English and maths, are considered in the I/E comparisons, students' self-concepts are subjected to both external comparison of the same curriculum area with the environment (e.g. peers) as well as their own internal comparison with a different curriculum area. On the contrary, when a comparatively less salient verbal domain, Chinese in this case, is considered in the I/E comparisons with the maths domain, while the external comparison with other students in the same curriculum is still substantial, students are less inclined to compare their two subject areas internally. That also seems to imply that the achievement in a less salient subject domain has little or no influence over the self-concept of a nonmatching domain. This study has extended previous research in examining the applicability of the I/E model to bilingual higher education students and, more importantly, contributes to the knowledge concerning the relationships among self-concepts of different subject domains in a given academic environment.

Summary

The present study examines the applicability of the internal/external frame of reference in the self-concept development of higher education students based on two alternate models of comparison. The analysis showed the strength of the Marsh (1986) I/E model in describing the development of higher education students' self-concepts and

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its generalisability to a non-western culture. However, the I/E comparisons may exist only when both the verbal and maths achievements are salient sources of feedback for the development of self-concept in a given academic setting. Thus, similar to high school students, the development of higher education students' self-concepts in domain-specific curriculum areas is also based on social comparisons with other students in the same curriculum area. However, internal comparison of individual student's own competence in various curriculum areas may occur only when both sources of competence feedback are salient in the academic setting.

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